vPad-RF™

RFA Programmer's Guide for the vPad-RF ESU Analyzer

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RFA Programmer's Guide for the vPad-RF ESU Analyzer

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Chapter 1

1 Overview

vPad-RF is a test instrument intended for measuring the output of electrosurgical generators, also known as electrosurgical units or "ESUs". Tests performed by vPad-RF are based on measurement of high-frequency current delivered by the ESU to a preset load resistance. vPad-RF comprises an RF Analyzer unit (right), and an Android tablet which provides a user interface by means of the vPad-RF™ software or "app" installed on the tablet.

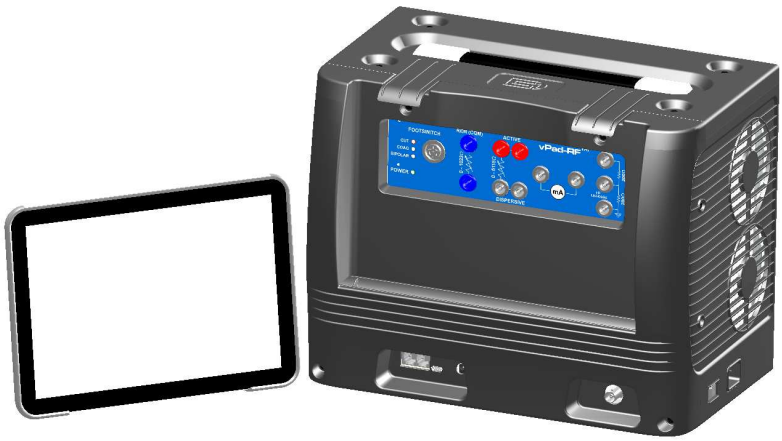

Figure 1

Inspection and testing of an ESU may be accomplished by using the vPad-RF app to execute an ***AutoSequence***. AutoSequences are automated sequences of inspection steps which can be integrated with user instructions, diagrams and measurements of the ESU's performance.

vPad-RF AutoSequences are ideally suited to preventive maintenance ("PM") inspection of ESUs in accordance with manufacturer specifications. An AutoSequence can guide a technician step-by-step through a manufacturer's PM inspection while automatically recording results to obtain a PM record or test report document on completion of the sequence. Automation of the PM procedure enables a PM to be completed more quickly and accurately, and with less prior experience or specific training on the part of the technician.

Example AutoSequences are installed on the Android tablet with the vPad-RF app. The example AutoSequences include PM inspection procedures for ConMed, Covidien, Olympus and Valleylab ESU models[1]. The PM procedures provided with vPad-RF may be copied and used as templates to write new PM procedures for other ESU models.

vPad-RF AutoSequences are script-based programs which are written in the vPad "***RFA***" language. Minor changes and updates to RFA scripts can be accomplished on the Android tablet using an editor app which is installed on the tablet. Programming of RFA scripts from scratch is more easily accomplished on a desktop or laptop computer, using a chroma-coded editor intended for writing program code or alternatively by using the Datrend ***vPad IDE™*** software for MS Windows™.

This guide is intended for those who wish to create ESU PM procedures and automated testing procedures for vPad-RF. The guide begins with an overview of how vPad-RF is used to perform automated inspection and testing of ESUs. The overview is followed by specification of the RFA scripting language, including language syntax and statement descriptions with examples. **MN-110 6100-087** ***vPad-RF Operators Manual*** provides further details on operation of vPad-RF and should be referenced in combination with this guide when developing AutoSequence programs.

[1] AutoSequence programs provided with vPad-RF are based on manufacturer's information available at the time the sequences were created and are subject to change without notice. Datrend provides these procedures as examples only and they should be reviewed and approved before use.

Chapter 2

2 Automated Testing

In an automated test sequence or "AutoSequence", ESU performance will be assessed through measurement of HF power output and HF leakage, and well as by confirming correct operation of the Return Electrode Monitor (REM) or Contact Quality Monitor (CQM) alarm. In addition to tests of performance, AutoSequences can include procedural instructions, drawings or schematics, and inspection checkpoints. AutoSequences are ideal for performing preventive maintenance (PM) inspections of electrosurgical equipment in accordance with manufacturer's specifications.

2.1.1 Selecting and Starting a Test

An automated test or PM procedure is selected by pressing the "AutoSequences" button on the main menu of the vPad-RF app.

Figure 2

Each AutoSequence corresponds to a "**`.rfa`**" file in the **`Datrend/vPad-RF/AutoSequences`** folder on the tablet. The AutoSequence selector menu displays the filenames in ascending alphabetical order, but without the "**`.rfa`**" file extension.

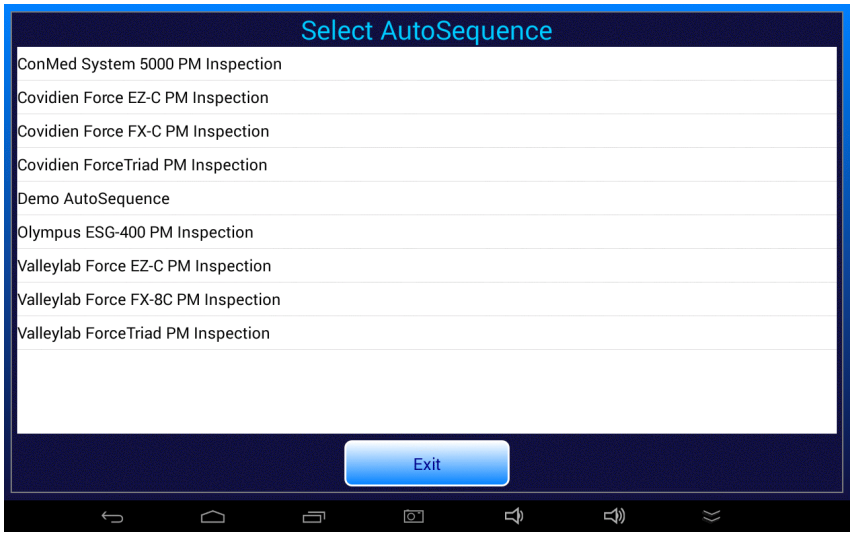

Figure 3

The desired test or PM inspection is selected by pressing a row of the "Select Autosequence" menu. As a first step, the user is prompted to input information about the ESU under test.

Figure 4

The equipment information may be entered now, or this step may be skipped and the procedure begun immediately by pressing the "Next Step" button. To save a record of the test, the user must enter the control number or ID of the ESU being tested. If the ID has not been entered at the time the test sequence is completed, the user will be prompted to enter it then.

2.1.2 Test Execution

After inputting or skipping the equipment information, the automated test is executed as a series of steps which are performed sequentially, one after the other.

Figure 5

The "Next Step" button may be pressed to increment to the next step of the sequence. The "Previous Step" button may be pressed to review prior instructions or results. The "Quit Test" button aborts the test and discards acquired results.

During a PM inspection, a fault in the equipment may be encountered which cannot be corrected at time of test. In this case, the "Finish Test" button could be pressed to create a Test Record of results acquired up that point in the procedure[2]. After performing the required service to repair the fault, the AutoSequence/PM is then repeated from the beginning.

---

2 Since the PM is incomplete, the Test Record will be assigned a "FAIL". A record of failed equipment may not seem particularly helpful, however, provided faulty equipment is identified and quarantined for repair, the Test Record provides evidence that the PM completion requirement of the equipment management system has been addressed.

The user will follow instructions as these are displayed during the procedure. Certain steps may require the user to examine a schematic or photograph. The user can choose to press the "Show Picture" button when such steps are encountered. If necessary, pinch-zoom and drag gestures may be used to expand specific areas of displayed images.

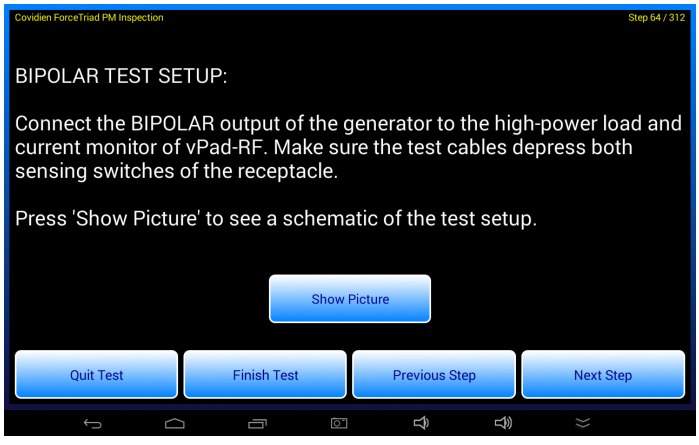

Figure 6

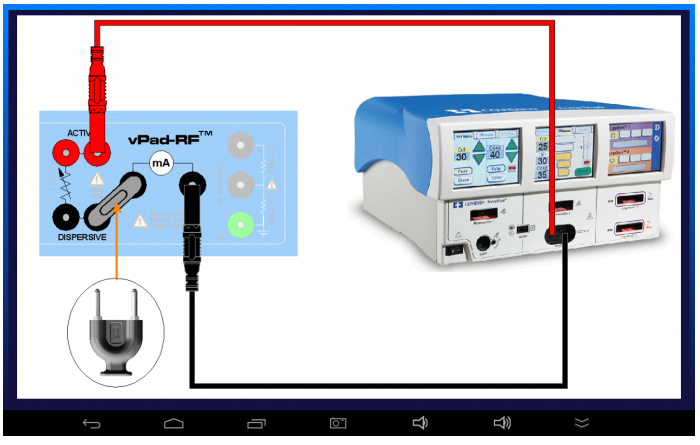

Figure 7

After a drawing or photograph has been displayed, the image viewer can be exited by pressing the BACK button , which returns the user to the sequence in progress.

Inspection steps or "checks" require the user to examine the ESU and then select "PASS", or otherwise an alternative result such as "FAIL", "SERVICE", "INFO" or "N/A" (not applicable).

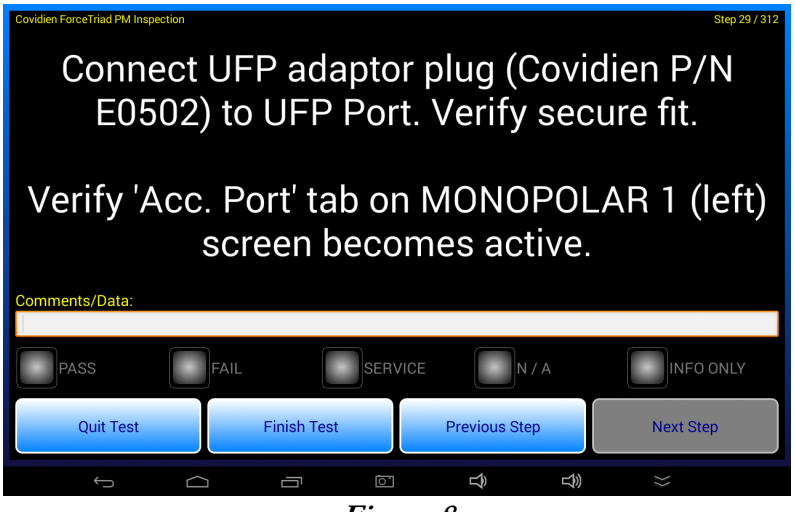

Figure 8

Choosing "PASS" as the result causes the sequence to advance to the next step automatically. Choosing a result other than "PASS" causes the app to prompt the user for a rationale for that result. For results other than "PASS", users must enter a reason after which the sequence will be permitted to move on with the next step. For these inspection steps, data entry can be performed via the soft keyboard which is displayed when the "Comments/Data" box is touched, or if a result other than "PASS" is selected. Alternatively, data can be entered automatically by using a barcode scanner to scan preprinted "PASS", "FAIL" or "SVC" (service) barcodes.

Steps which evaluate ESU performance will measure HF output, HF leakage to earth, or REM (CQM) alarm response. For specific details on how the user will set up and perform these measurements, refer to Chapter 4 of **MN-110 6100-087** ***vPad-RF Operators Manual***. In an AutoSequence, each performance test will include pass/fail limits for the measurement result. If the measurement falls within acceptable limits, the sequence advances to the next step automatically after a short delay.

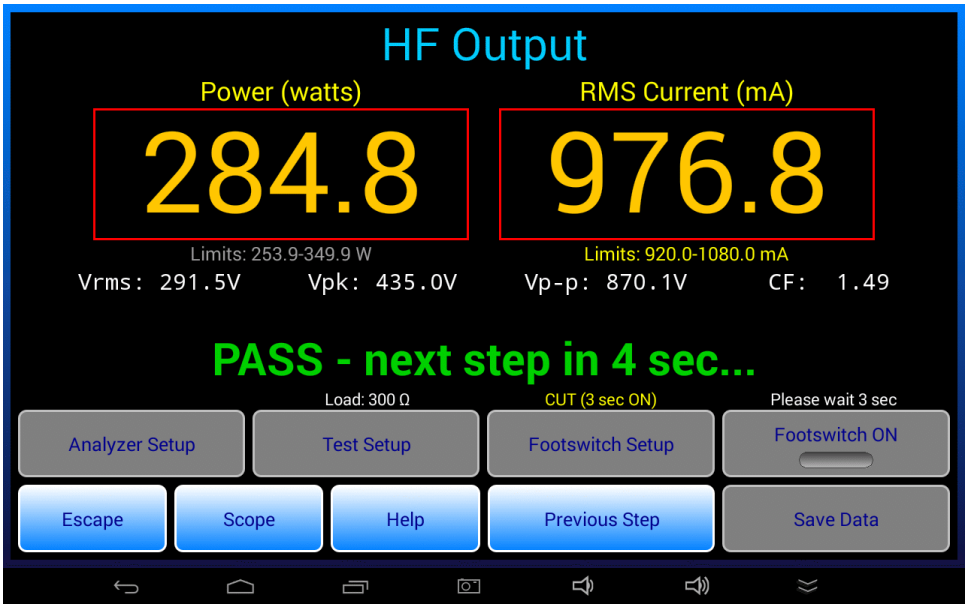

Figure 9

If instead of "PASS" the measurement is a "FAIL", the sequence stops at the current step which enables the user to correct the problem and repeat the measurement.

At the end of the sequence, the user is shown a summary of the results and is prompted to create a Record of the test. Test Records saved by vPad-RF are stored in the **`Datrend/vPad-RF/Records`** folder of the Android tablet. The Test Record filename is auto-generated based on the control number as shown in the example of ***Figure 10***.

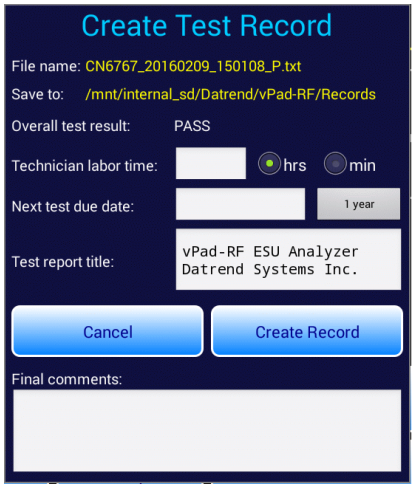

Figure 10

If a control number or equipment ID was not input at the start of the test, the user is prompted to enter it at this point by means of a dialog. Once an ID has been entered, the user may then save the Test Record.

Test Records which have been saved by vPad-RF can be reviewed by pressing the "Test Records" button on the main menu of the app. This button launches the vPad Record Manager app which will allow such Records to be converted from the native format to PDF, printed, transmitted to a PC by Bluetooth or through the internet, or copied to a USB flash drive that has been connected to the Android tablet.

Figure 11

More information on the vPad Record Manager app may be found in **MN-087 6100-081 *vPad-RM Operators Manual***.

Chapter 3

3 RFA Programming

vPad-RF AutoSequences correspond to a set of files which are stored in the vPad-RF directory of the Android tablet. An AutoSequence file contains a ***computer program*** which has been written in an AutoSequence programming language called "***RFA***". Each step of an AutoSequence procedure has a direct one-to-one relationship with a corresponding RFA ***statement*** in the AutoSequence file. RFA statements can display instructions, show photographs, accept data input from the user, and can execute specific performance tests on an electrosurgical generator such as HF output power or HF leakage.

This chapter specifies the RFA language and explains how RFA may be used to create PM inspection procedures and automated test sequences for electrosurgical units (ESUs).

3.1 AutoSequence Files

3.1.1 File Location

vPad-RF AutoSequence files are stored in this directory of the Android tablet:

`<storage_media>/Datrend/vPad-RF/AutoSequences`

The **`<storage_media>`** refers to the memory installed in the Android tablet and its name will depend on the make and model of the tablet. This may be **`mnt/sdcard`** or **`mnt/internal_sd`**, or a similar reference which includes characters "*sd*" in the name.

3.1.2 Filenames

vPad-RF AutoSequence files have a "**`.rfa`**" file extension. Typically, the filename will refer to the electrosurgical generator to be inspected and/or tested, for example:

```
ConMed System 5000 PM Inspection.rfa
Covidien ForceTriad PM Inspection.rfa
Olympus ESG-400 PM Inspection.rfa
```

Filenames may refer to specific ESU manufacturers and model numbers as in the above examples, or they may refer to a ESU in a generic way, for example: **`Hyfrecator PM Inspection.rfa`**

As shown above, filenames may include whitespace characters and they can also include comma characters.

3.1.3 File Editing

RFA files are text files that may be edited with any text editor or word processor.

You can use the text editor app installed on the Android tablet to edit RFA files. Alternatively, you can copy RFA file(s) to a personal computer (PC), make changes, and copy the file(s) back to the tablet.

You may find it easier to write AutoSequences on a PC with a ***source code editor***. A source code editor is a text editor program designed specifically for editing source code of computer programs by programmers. Source code editors provide ***syntax highlighting*** which makes computer programs easier to read.

A source code editor that allows you configure the syntax highlighting is best for programming AutoSequences. EditPlus (www.editplus.com) is an example of a source code editor with user-definable syntax settings. EditPlus is shareware, but there are other editor programs which can be downloaded from the internet for free from various sources (e.g. http://sourceforge.net/).

Figure 13 shows how an AutoSequence appears when it is being edited with EditPlus[3]. Note how the source code editor has automatically highlighted various items within the RFA program code (green for comments; blue for keywords; pink and black for text; and red for arguments).

As an alternative to a conventional source code editor, the vPad Integrated Development Environment (IDE) for Microsoft Windows™ can be used to program AutoSequences (see ***Figure 14***). In addition to providing a text editor with syntax highlighting, ***vPad IDE™*** includes a number of other features to streamline creation and management of vPad-RF AutoSequences and other PM procedures, for example, PM Checklists for use with the vPad-Check™ app. To simplify programming, vPad IDE includes a graphical editor which enables a programmer to see the AutoSequence steps as they would be displayed by the Android tablet. vPad IDE also includes a number of data transfer features to streamline the process of deploying AutoSequences created on the PC to tablets in the field, and to copy AutoSequences from a tablet into the IDE's environment. AutoSequences developed in vPad IDE can be tested on the Windows PC with an Android Emulator before being deployed to tablets. vPad IDE is available for free download from the Datrend website, www.datrend.com.

[3] Requires installation of **`rfa.stx`** syntax file for EditPlus, available from Datrend Systems. To obtain the syntax file, email a request to customerservice@datrend.com

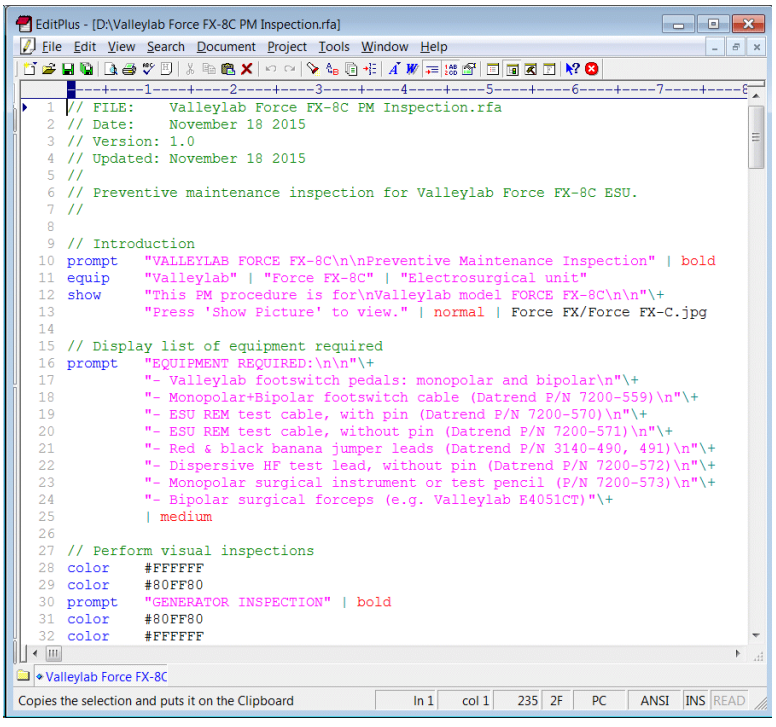

Figure 13 - *Editing a RFA file with EditPlus.*

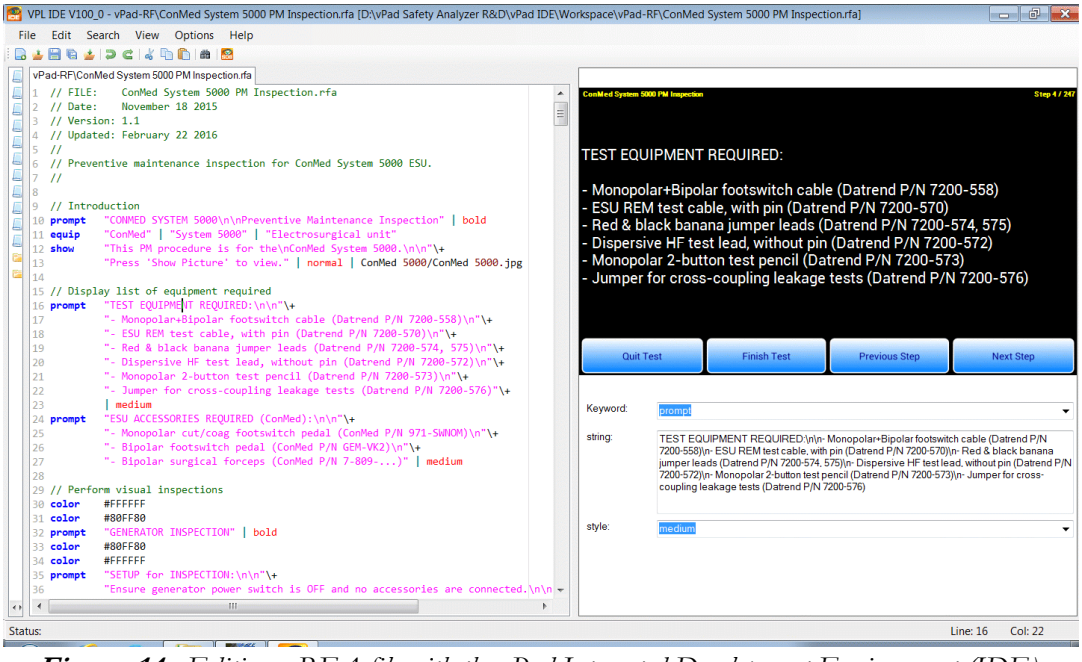

Figure 14 - *Editing a RFA file with the vPad Integrated Development Environment (IDE).*

3.2 AutoSequence Structure

3.2.1 Blank Lines

Blank lines may be placed anywhere in a RFA AutoSequence script and will be ignored by vPad-RF when the AutoSequence is executed. Blank lines are useful for separating the script into logical sections.

3.2.2 Comments

Comments may be placed within an AutoSequence script to explain what the program does or how it works. Any line that begins with a double-slash **//** is considered a comment by vPad-RF and will be ignored when the AutoSequence is executed. A comment must be placed on its own line; a comment cannot be placed inside of a RFA statement or on the same line as a statement.

```
// This is an example of a comment
// And here is another comment following the first comment
```

3.2.3 Statements

Each step of an AutoSequence has a direct one-to-one relationship with a corresponding RFA ***statement***.

Every RFA statement begins with a ***keyword***. The keyword is then followed by a list of one or more ***arguments***, where the arguments are separated by the pipe character (**|**):

```
keyword    <argument_1> | [argument_2] | [argument_3] ...
```
[4]

There must be at least one whitespace between the keyword and the first argument. Arguments following the first may be optional and will depend on the keyword. The use of whitespace on either side of a pipe character is optional but helps to make the program more readable.

[4] In this manual, **< >** brackets are used to indicate the required or mandatory arguments of a RFA statement, and **[ ]** brackets are used to indicate optional arguments.

3.2.4 Keywords

The following keywords are defined in the RFA language:

Keyword	Description
prompt	Displays information or instructions to the user.
show	Displays a drawing (PNG) or a photo (JPG).
check	Pass/fail inspection with optional user input.
color	Sets the foreground colour of text as displayed by **prompt**, **show**, and **check** statements.
equip	Auto-populates manufacturer, model and description fields of the equipment information prior to execution of the first step of the AutoSequence.
analyzer	Similar to the "**Analyzer Setup**" menu of the app, this statement configures range, averaging, trigger polarity and trigger level of the digital signal processor (DSP) in the RF Analyzer unit.
autosave	May be set to **on** or **off** to respectively enable or disable automatic saving of HF output or leakage results on completion of a measurement.
timers	Sets ESU footswitch ON-time, measurement delay, and **autosave** delay time.
hfload	Sets the HF load to a specified value of resistance ranging from 0 to 5115 ohms.
fans	Sets the cooling fans of the HF load to **off**, **low**, **medium** or **high** speed.
remres	Sets the REM/CQM test resistor to a specified value ranging from 0 to 1023 ohms.
hftest	Performs a test of ESU output power or current by launching the "**HF Output**" menu of the vPad-RF app. The test is performed with the internal HF load of the RF Analyzer unit.
hftestx	Same function as **hftest**, except that an external load resistance is used.
leakage	Performs a test of ESU HF leakage to earth by launching the "**HF Leakage**" menu of the app.
remtest	Performs a test of ESU REM/CQM alarm operation by launching the "**REM (CQM) Test**" menu of the app.
curve	Runs a previously-configured power curve test sequence ("**.pc**" file).

Keywords may be written in either upper or lower case letters. The use of lower case is a convention.

3.2.5 Strings

Following the keyword, the first argument of a RFA statement may be a ***string*** of characters. A string is a message that will be displayed by vPad-RFA when the statement is executed.

A string may be surrounded by double-quotation marks. Enclosing strings with double-quotes is optional in RFA, but it is a convention to do so in other computer languages and it will make the strings appear highlighted in a different colour when using a source code editor or the vPad IDE.

If double-quotes are used inside of a string, then they will be removed before the message is displayed by vPad-RF. If it is necessary to emphasize a part of a message, use the single-quote character in strings.

Here are some examples of simple, single-line strings:

```
"Connect power cord of generator to AC supply"

"Check monopolar instrument receptacle on front panel"

"Set switch to 'OFF' position"
```

In the last example, note the use of single-quotes to emphasize 'OFF'.

3.2.6 Newline Character Sequence

A line break may be placed inside of a string by using the **\n** character sequence. This is done to achieve a certain appearance or arrangement of the text when the message is displayed by vPad-RF.

Here is an example of a string which includes some newline characters:

```
"Apply power to ESU.\n\nVerify all indicators light up,\nand activation tone is heard."
```

By default, vPad-RF will center-justify strings for display, unless a style is specified which overrides the default. If the above string was displayed with default center-justification, the three newlines **\n** will cause the message to appear as follows:

Apply power to ESU.

Verify all indicators light up,
and activation tone is heard.

3.2.7 Line Continuation Sequence

Many statements will be short enough to be placed on a single line in the text editor. Some statements, however, may have a very long string, a large number of arguments, or both.

When a statement is too long to easily fit on a single line on the editor's screen, the statement may be broken up into several lines using the **\+** character sequence, which is placed at the end of each partial line of the statement. The **\+** sequence is used only to make the AutoSequence program more human-readable and it has no effect on how the statement will be executed by vPad-RF.

When a statement has a long string that has been formatted into paragraphs by the **\n** sequence, the **\+** sequence may be placed at the end of each line in the paragraph to make the statement more readable. Note it is the **\n** which controls the formatting of the displayed message, not the **\+**.

Here is an example of a **remtest** statement, illustrating the use of the **\+** sequence:

```
remtest  "Resistance is now set to 60 ohms. Confirm ESU alarm\n"\+
         "is OFF and REM indicator is GREEN."\+
         | off \+
         | 60 \+
         | match \+
         | 60
```

This example shows a **\+** continuation sequence after each line of the string argument, and also following each additional argument after the string.

This statement can be rewritten with fewer line continuation marks. The following statement will produce exactly the same result from vPad-RF as the one shown above.

```
remtest  "Resistance is now set to 60 ohms. Confirm ESU alarm\nis OFF and REM "\+
         "indicator is GREEN." | off | 60 | match | 60
```

The statement could also be written with no **\+** sequences at all. In that case, the statement would likely extend outside the margins of a page as displayed by a text editor on a PC, but it would still be an executable statement as far as vPad-RF is concerned.

3.3 prompt Statement

Syntax: **`prompt <string> | [style]`**

Description: The **`prompt`** statement displays a text string in a specified style. It is typically used to display titles and user instructions, for example, instructions for setting up the ESU under test.

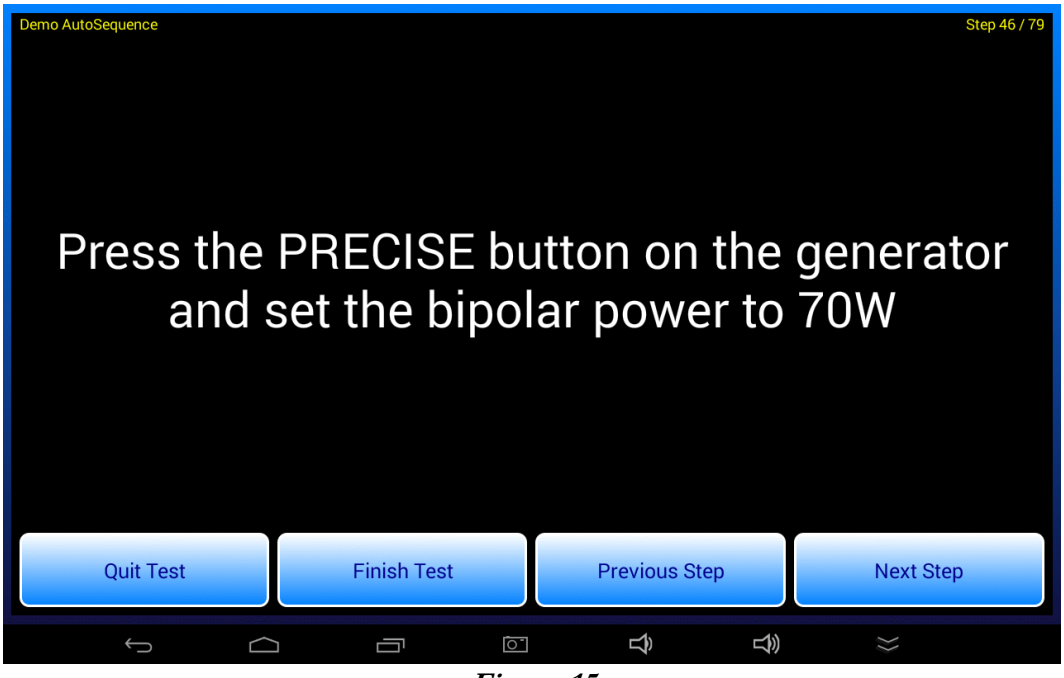

Figure 15

The string is the only required argument. The style is optional and if not specified a default style of **`normal`** will be used.

Styles are defined in the table on the following page. All styles will automatically word wrap to make the string fit in the designated space on the LCD display. The newline character sequence **`\n`** may be used in strings to override the default word wrapping.

Style	Font			Paragraph Justification	Left/Right Margins
	Rel. Size	Colour	Character Spacing		
normal (default)	60	white*	Proportional	Centered	0 pixels
bold	60-bold	white*	Proportional	Centered	0 pixels
red	60-bold	red	Proportional	Centered	0 pixels
medium	38	white*	Proportional	Left	0 pixels
mmono	32	white*	Uniform	Left	90 pixels
small	22	white*	Uniform	Left	200 pixels

* Default font colour for these styles is white. Text colour can be modified with the '**color**' statement. See Section 3.6.

Additional styles are:

bell This has the same appearance as **normal** style, and adds a bell sound which is played when the prompt is shown.

alert This has the same appearance as **red** style, and adds an alert tone which is played when the prompt is shown.

Examples:

```
prompt "Press the PRECISE button on the generator\n"\+
       "and set the bipolar power to 70W"

prompt "BEGIN ESU INSPECTION" | bold

prompt "WARNING: HIGH VOLTAGE!" | red

prompt "ATTENTION!\nDisconnect REM test cable now." | bell
```

Here are some additional **prompt** examples, with **medium** and **small** font respectively:

```
prompt "EQUIPMENT REQUIRED:\n\n"\+
       "- Monopolar and bipolar footswitch pedals\n"\+
       "- Monopolar+Bipolar footswitch control cable (Datrend P/N 7200-559)\n"\+
       "- ESU REM test cable, with pin (Datrend P/N 7200-570)\n"\+
       "- Red & black banana jumper leads (Datrend P/N 7200-574, 575, 582)\n"\+
       "- Dispersive HF test lead, without pin (Datrend P/N 7200-572)\n"\+
       "- Monopolar surgical instrument or test pencil (Datrend P/N 7200-573)\n"\+
       "- Bipolar surgical forceps" | medium


prompt "CUT FOOTSWITCH TEST:\n\n"\+
       "Depress the CUT treadle of the monopolar footswitch. The dispersive "\+
       "electrode alarm should sound and dispersive electrode indicators "\+
       "should flash alternating red.\n\n"\+
       "While holding the CUT treadle, rotate the volume controls on the rear "\+
       "panel of the generator and verify there is no significant change in "\+
       "sound level as the controls are rotated over their full range.\n\n"\+
       "Release the CUT footswitch and the tone should stop." | small
```

3.4 show Statement

Syntax: **`show <string> | <style> | <filename>`**

Description: The **`show`** statement displays a text string in a specified style, with a "**Show Picture**" button beneath the text. When the button is pressed, the image file specified by **`<filename>`** is opened and shown on the tablet. Supported image types are **`png`** and **`jpg`**.

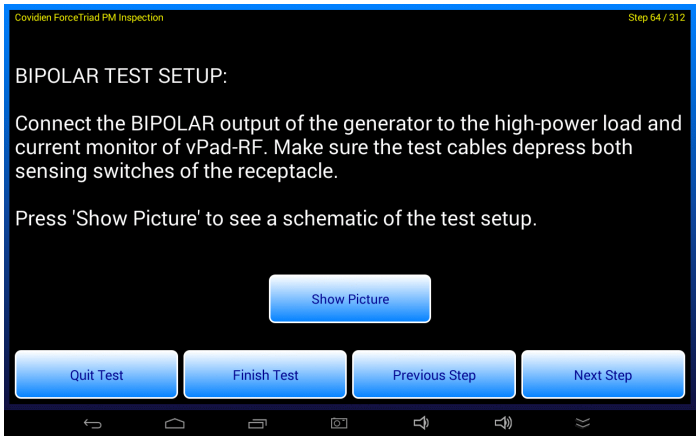

Figure 16

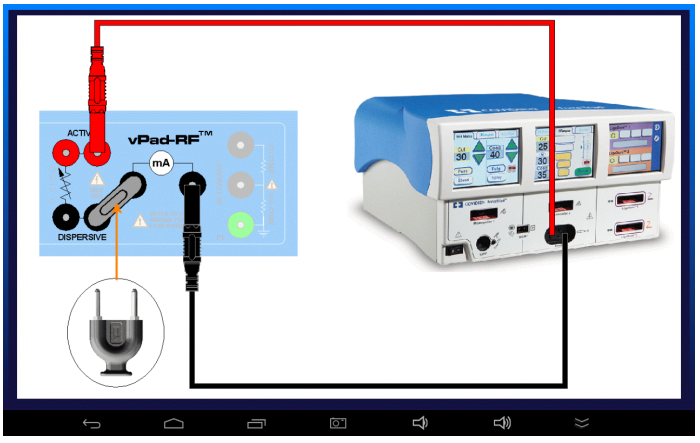

Figure 17

All arguments of the **`show`** statement are required. Text styles are the same as those specified for the **`prompt`** statement (see Section 3.3).

Image files referenced by the **`show`** statement must be stored in this folder on the tablet:

`<storage_media>/Datrend/vPad-RF/AutoSequences/Show`

Optionally, image files may be organized in subfolders within the **`AutoSequences/Show`** folder. Most of the example AutoSequences provided with vPad-RF use this approach, in which images referenced by an AutoSequence are placed in a subfolder named with the pertinent ESU model. When a subfolder is used, the **`<filename>`** argument of the **`show`** statement will then include the subfolder name in combination with the name of the image file:

`<filename>` ☞ **`<subfolder/image_file>`**

Examples:

```
show "BIPOLAR TEST SETUP:\n\n"\+
     "Connect the BIPOLAR output of the generator to the high-power load and "\+
     "current monitor of vPad-RF. Make sure the test cables depress both "\+
     "sensing switches of the receptacle.\n\n"\+
     "Press 'Show Picture' to see a schematic of the test setup."\+
     | medium | ForceTriad/HF Output - ForceTriad Bipolar.png


show "Connect the Monopolar+Bipolar footswitch control cable from vPad-RF "\+
     "to corresponding footswitch inputs on the rear panel of the ESU.\n\n"\+
     "Press 'Show Picture' to see a schematic of the footswitch setup.\n\n"\+
     "In tests which follow, vPad will switch the generator ON automatically."\+
     | medium | Footswitch Connections.png
```

3.5 check Statement

Syntax: **`check <string>`**

Description: The **`check`** statement displays a text string along with radiobuttons and a text box for user input of data or comments.

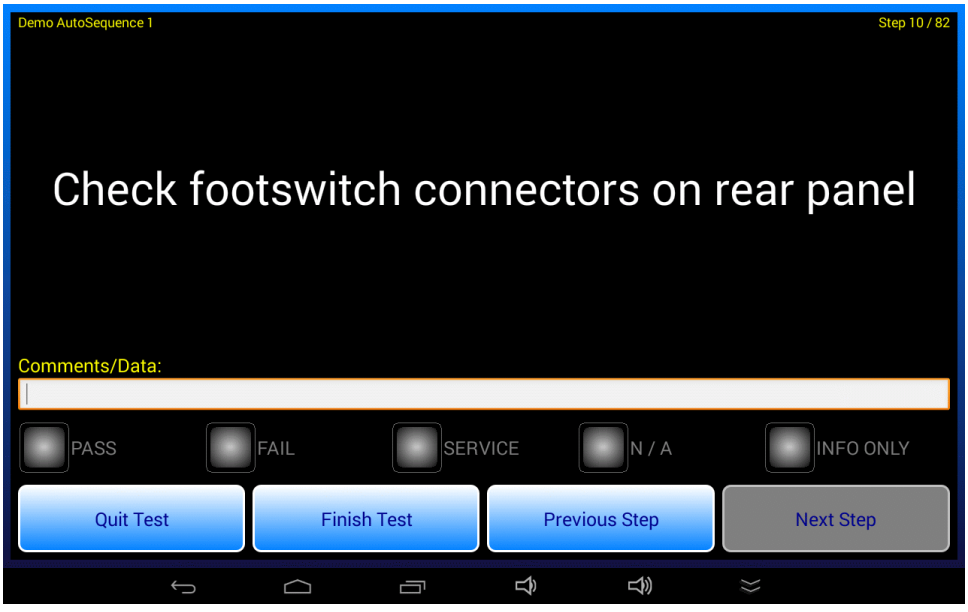

Figure 18

This statement saves information to the Test Record. The radiobutton which is pressed is recorded as the test result for the AutoSequence step. Contents of the comments/data text box, if any, are saved as the test data for the step. The **`<string>`** of the statement is also saved, to give the recorded data and result some context.

Examples:

```
check "Check footswitch connectors on rear panel"

check "Check power cord, plug and strain relief"

check "Indicators and displays...\n\nCheck operation"

check "Controls and switches...\n\nCheck operation"
```

3.6 color Statement

Syntax: **color <rgb_setting>**

Description: Sets the foreground colour of text as displayed by **prompt**, **check** or **show** statements. **rgb_setting** is a 24-bit number in hexidecimal notation which specifies the relative mix of red, green and blue in the overall colour. The argument begins with a '#' character, followed by red, green and blue values with each component respectively ranging from 00 (black) to FF (maximum intensity).

By default, Checklists display text in white (**rgb_setting** = #FFFFFF). When required, the default colour can be changed by preceding a **prompt** or other statement with a **color** statement. The colour setting remains in effect until changed by a subsequent **color** statement.

Examples:

```
color  #FF0000
prompt "This text will appear in bright red"

color  #00FF00
prompt "This text will appear in bright green"

color  #0000FF
prompt "This text will appear in bright blue"

color  #FFFF00
prompt "This text will appear in bright yellow"

color  #F8F8A0
prompt "This text will appear in a softer yellow"

color  #FFC700
prompt "This text will appear in orange"

color  #0080FF
prompt "This text will appear in a medium blue"

// Reset text colour to default (white)
color  #FFFFFF
```

3.7 equip Statement

Syntax: **`equip <manufacturer> | <model> | <description>`**

Description: The **`equip`** statement auto-populates manufacturer, model and description fields of the equipment information prior to execution of the first step of the AutoSequence program.

This statement may be placed anywhere in the RFA script, but since most AutoSequences are specific to an ESU make and model, it makes sense to place the **`equip`** statement near the beginning of the program.

This statement has no UI and the script automatically increments to the next step once the statement has been executed.

Examples:

```
equip  "ConMed" | "System 5000" | "Electrosurgical unit"

equip  "Valleylab" | "Force FX-8C" | "Electrosurgical unit"
```

3.8 analyzer Statement

Syntax: **`analyzer <range> | <averaging> | <trigger>`**

Description: Similar to the "**Analyzer Setup**" menu of the vPad-RF app, this statement configures range, averaging, trigger polarity and trigger level of the digital signal processor (DSP) in the RF Analyzer unit.

All arguments of the **`analyzer`** statement must be specified. These arguments are:

`range` Selects the measurement range of the RF Analyzer unit. If set to **`auto`**, automatic ranging is enabled. Otherwise, the argument may be set to one of the following integer values to select a specific range:

`1`	Selects 0.5 amp range
`2`	Selects 1 amp range
`3`	Selects 3 amp range
`4`	Selects 6 amp range
`5`	Selects 12 amp range

`averaging` Selects the DSP averaging mode. Defined settings are **`normal`**, **`slow`** or **`mpulse`** (multi-pulse averaging)

`trigger` Sets the DSP trigger level and polarity. This is an integer value which may range from **`-99`** to **`+99`**.

Default analyzer settings assigned at AutoSequence startup are **`auto`**, **`normal`**, and **`+5`** respectively. Accordingly, an AutoSequence program does not need to include an **`analyzer`** statement unless a change to these default settings is needed.

This statement has no UI and the script automatically increments to the next step once the statement has been executed.

Examples:

```
// Select 0.5A range, enable pulsed measurements, and
// reduce trigger level to near minimum
analyzer  1 | mpulse | +1


// Restore RF analyzer setup to defaults
analyzer  auto | normal | +5
```

3.9 autosave Statement

Syntax: **autosave <mode>**

Description: The **mode** argument of the **autosave** statement may be set to **on** or **off** to respectively enable or disable automatic saving of HF output or HF leakage results on completion of a measurement.

If **autosave** is ON, the test sequence will automatically advance to the next step after a preset delay if the measurement is assigned a "PASS". If a measurement is assigned a "FAIL", automatic saving is inhibited regardless of **autosave** on/off configuration and the user must acknowledge the FAIL manually.

The autosave delay time is configured by the **timers** keyword (see Section 3.10). Default on AutoSequence startup is **autosave off** and so if automatic saving is desired it must be explicitly enabled at an appropriate step in the script by an **autosave on** statement.

This statement has no UI and the script automatically increments to the next step once the statement has been executed.

Examples:

```
// Enable automatic saving of "PASS" results
autosave  on

// Disable automatic saving of "PASS" results
autosave  off
```

3.10 timers Statement

Syntax: **timers <autosave_time> | <footsw_on_time> | <meas_delay>**

Description: The **timers** statement configures footswitch control timing as well as the time delay for the **autosave** feature (see Section 3.9).

All arguments of the **timers** statement must be specified. These arguments are:

autosave_time This is the autosave delay for a "PASS" measurement result. It is an integer value which may range from 2 to 10 seconds.

footsw_on_time This is an integer value specifying the time, in seconds, which the ESU footswitch control is held "ON" to perform a measurement. This value may range from 1 to 20 seconds.

meas_delay This is a decimal value in seconds specifying the measurement hold-off delay following activation of the ESU. This value may range from 0.0 up to a maximum of the **footsw_on_time** minus 0.5 seconds.

Default settings assigned at AutoSequence startup are 3 seconds, 3 seconds and 0.3 seconds for **autosave_time**, **footsw_on_time** and **meas_delay** respectively. Accordingly, an AutoSequence program does not need to include a **timers** statement unless a change to these defaults is needed.

This statement has no UI and the script automatically increments to the next step once the statement has been executed.

Examples:

```
// Set footswitch ON-time to 5 seconds and measurement delay
// to 0.5 seconds. Leave autosave at default.
timers  3 | 5 | 0.5

// Restore timer setup to defaults
timers  3 | 3 | 0.3
```

3.11 hfload Statement

Syntax: **hfload <resistance>**

Description: Sets the HF load bank of the RF Analyzer to a specified resistance ranging from **0** to **5115** ohms. This setting will be overridden when a **hftest** or **leakage** statement is executed (see Sections 3.14 and 3.16 following).

Script-based control of the HF load is necessary in certain visual inspections and tests where the ESU actively drives a load but there is no requirement to *measure* the resulting RF output.

This statement has no UI and the script automatically increments to the next step once the statement has been executed.

Example:
```
// Set the load in the RF Analyzer to 675 ohms
hfload   675
```

3.12 fans Statement

Syntax: **fans <speed>**

Description: Sets the cooling fans of the HF load to **off**, **low**, **medium** or **high** speed. This setting will be overridden when a **hftest** or **leakage** statement is executed.

Note that script-based control of the fans may be necessary in certain visual inspections and tests where the ESU actively drives a load but there is no requirement to *measure* the resulting RF output.

This statement has no UI and the script automatically increments to the next step once the statement has been executed.

Examples:
```
// Set cooling fans to maximum
fans   high

// Switch the fans OFF
fans   off
```

3.13 remres Statement

Syntax: **remres <resistance>**

Description: Sets the REM/CQM test resistor of the RF Analyzer unit to a specified value ranging from **0** to **1023** ohms. This setting will be overridden when a **remtest** statement is executed (see Section 3.17).

When used in combination with appropriate **prompt** and **check** statements, **remres** statements enable an alternative method of REM/CQM testing which is followed by some manufacturers but which cannot be easily implemented with conventional **remtest** statements. See the **Olympus ESG-400 PM Inspection** AutoSequence on the Android tablet for an example.

This statement has no UI and the script automatically increments to the next step once the statement has been executed.

Example:
```
// Set REM/CQM test resistor to 140 ohms
remres   140
```

3.14 hftest Statement

Syntax: **`hftest <wave>|<mode>|<load>|<lo_limit>|<hi_limit>|<units>`**

Description: The **`hftest`** statement launches the "**HF Output**" menu of the vPad-RF app, passing to this menu the following information: the ESU output under test (cut, coag or bipolar); the mode by which the ESU is to be controlled (automatic footswitch, or manually-operated handswitch/footswitch); the resistance setting for the internal HF load bank; and the pass/fail range for the measured HF power (in watts), or alternatively the HF current (in mA).

All arguments of the **`hftest`** statement must be specified. These arguments are:

`wave` Describes the waveform (i.e. surgical function) to which the ESU under test has been set. Typical examples would include descriptions such as "Monopolar Pure Cut"; "Monopolar Blend 2"; "Monopolar Spray Coag"; "Bipolar Precise" and so on. When the HF test is completed, this description is then saved with the measurement result to provide a record of the ESU condition under which the test was performed.

`mode` Specifies which output of the ESU is being tested, and how the ESU is to be activated to perform the test. The settings defined for this argument are:

- **`a-cut`** The monopolar CUT output of the ESU is activated automatically by vPad-RF, via a footswitch control cable
- **`a-coag`** The monopolar COAG output of the ESU is activated automatically by vPad-RF, via a footswitch control cable
- **`a-bipolar`** The BIPOLAR output of the ESU is activated automatically by vPad-RF, via a footswitch control cable
- **`m-cut`** The user will be prompted by vPad-RF to manually activate the monopolar CUT output of the ESU, via a footpedal control or a hand-operated control such as a "test pencil"
- **`m-coag`** The user will be prompted by vPad-RF to manually activate the monopolar COAG output of the ESU, via a footpedal control or a hand-operated control such as a "test pencil"
- **`m-bipolar`** The user will be prompted by vPad-RF to manually activate the BIPOLAR output of the ESU, via a footpedal control

m-rf The user will be prompted by vPad-RF to manually activate the ESU. In this case, the particular output of the ESU that is under test is not explicitly specified in the **hftest** statement. The **m-rf** argument is for AutoSequence programs in which the necessary instructions for setup and testing of the ESU are provided by one or more **prompt** statements which precede the **hftest** statement. See the **ForceTriad PM Inspection** AutoSequence on the Android tablet for an example of how the **m-rf** argument may be used.

load The resistance setting of the internal load bank in the RF Analyzer unit, in ohms. This is an integer value which may range from 0 to 5115.

lo_limit A positive decimal number specifying the lower limit of the pass/fail acceptance range.

hi_limit A positive decimal number specifying the upper limit of the pass/fail acceptance range. This number should be greater than **lo_limit**.

units The units of measure of the **lo_limit** and **hi_limit**. This argument may be set to:

mA The pass/fail limits are applied to the measurement result for the HF output current

watts The pass/fail limits are applied to the measurement result for the HF output power

Examples:

```
// Test pure cut, 80W into 300 ohms; acceptance range = 479-553 mA
// ESU CUT switched on/off automatically, by vPad-RF
hftest  "Monopolar PURE CUT, 80W" | a-cut | 300 | 479 | 553 | mA

// Test coag, 120W into 500 ohms; acceptance range = 465-514 mA
// ESU COAG switched on/off automatically, by vPad-RF
hftest  "Monopolar PINPOINT coag, 120W" | a-coag | 500 | 465 | 514 | mA

// Test bipolar, 100W into 500 ohms; acceptance range = 82-122 W
// ESU switched on/off manually by user, via footpedal control
hftest  "BipolarCut, 100W" | m-bipolar | 500 | 82 | 122 | watts
```

Operation: When the **hftest** statement is executed, the HF Output menu of the vPad-RF app is launched and will appear similar to the example shown in ***Figure 19***.

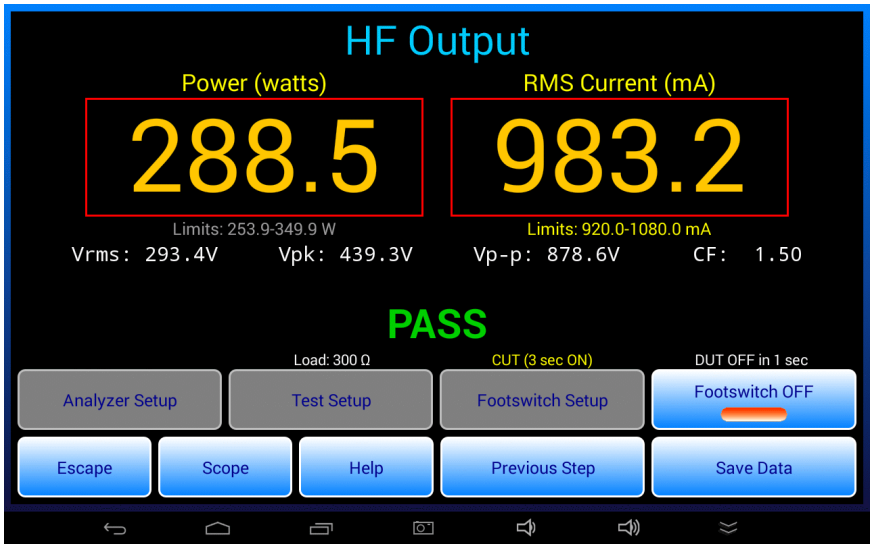

Figure 19

In AutoSequence mode, "Analyzer Setup" and "Footswitch Setup" buttons on the menu are disabled as shown. Analyzer settings may be the defaults assigned at AutoSequence startup, or as optionally configured by a preceding **analyzer** statement (see Section 3.8). Footswitch timing may be the startup defaults, or as configured by a preceding **timers** statement (see Section 3.10).

The "Test Setup" button on the menu is also disabled. The load and pass/fail range are specified in the **hftest** statement that displays this menu. The pass/fail range may be specified in units of **mA** or **watts** and is shown in yellow; the implicitly-specified pass/fail range (either W or mA) is derived by the app based on the load resistance and is shown in grey.

If the **mode** argument of the statement is set to **a-cut**, **a-coag** or **a-bipolar**, the corresponding footswitch output of vPad-RF is automatically activated on entry to the HF Output menu. This is the situation represented by ***Figure 19***, for which the **mode** argument has been set to **a-cut**. In this case, the footswitch control timer is initialized with an ON-time which is 3 seconds by default, or as set by a preceding **timers** statement.

Once started, the "ON" timer counts down and, if **autosave** is set to **off**, the "Save HF Test Result" menu will appear automatically when the ON-timer reaches zero (***Figure 20***). See Section 3.9 for information on the **autosave** statement.

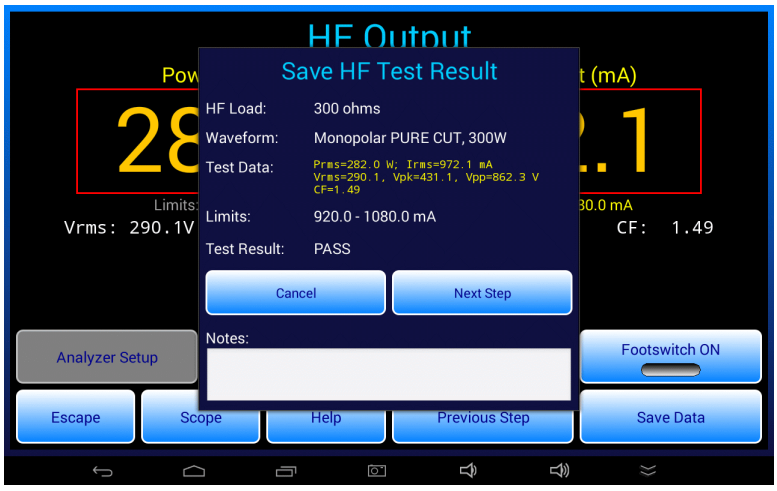

Figure 20

If **autosave** is **on**, and if the measurement is result is a "PASS" at the end of the footswitch ON-time, the "Save..." menu is not shown as in ***Figure 20***. Instead, "PASS" is displayed with a timer per ***Figure 21***. After the autosave countdown reaches zero, the sequence advances to the next step automatically

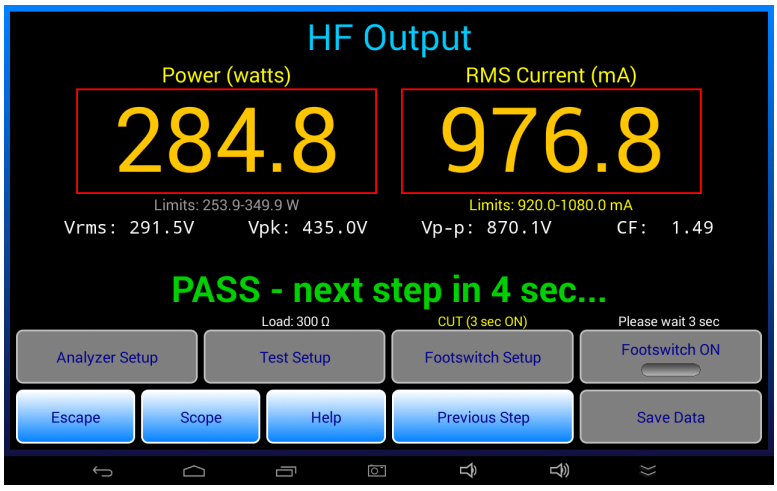

Figure 21

If **autosave** is **on** and the measurement result is "FAIL", the sequence does *not* proceed automatically after the ON-time. Instead, the "Save..." menu is displayed similar to ***Figure 20*** and the user must either accept the FAIL or alternatively press the "Cancel" button on the menu and then repeat the measurement. To repeat, the user can press the "Footswitch ON" button to activate the ESU.

If the **mode** argument of the **hftest** statement is set to **m-cut**, **m-coag**, **m-bipolar** or **m-rf**, the footswitch control output of vPad-RF is *not* activated on entry to the HF Output menu. Instead, an "Activate <....>" pop-up message is shown, where <....> may say CUT, COAG, BIPOLAR or RF per the **mode** argument. This is the situation shown in ***Figure 22***, for which the **mode** argument is set to **m-cut**. In this case, the ON-time does not begin to count down until an ESU signal is detected.

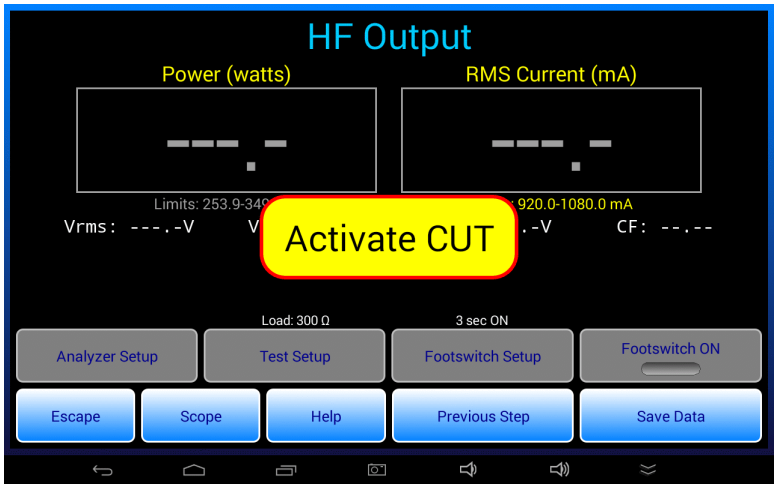

Figure 22

After an ESU signal is detected, the ON-timer counts down and when it reaches zero, a "Switch RF off!" pop-up message is automatically shown. If **autosave** is **off**, the "Save..." menu per ***Figure 20*** appears. If **autosave** is **on** and the result is a PASS, the sequence automatically advances to the next step after the autosave delay, per ***Figure 21***

The "Save Data" button on the menu has the same function as in manual testing. It may be pressed anytime to capture the currently displayed reading, which may be *zero* if there has been no reading. The PASS/FAIL result is assigned accordingly, based on the limits and the captured value(s).

If **autosave** is **off**, data shown on the "Save..." menu are copied to the Text Record and the sequence advances to the next statement when the menu's "Next Step" button is pressed. If **autosave** is **on**, the measurement data are automatically saved to the Test Record when the autosave timer counts down to zero.

3.15 hftestx Statement

Syntax: **hftestx <wave>|<mode>|<load>|<lo_limit>|<hi_limit>|<units>**

Description: The **hftestx** statement is nearly identical in syntax and function to the **hftest** statement described in Section 3.14. The **load** argument, however, differs in that it may specify an external resistance which by itself serves as the ESU load, or alternatively it may specify a sum of an internal load bank setting plus an external series resistance. The latter test configuration is specified by a **':'** character in the **<load>** which serves to delimit the values of the internal load bank and external resistance:

<load> ⇨ <internal_load : external_resistance>

Refer to Section 3.14 for more details on how the HF Output test is configured for operation in an AutoSequence.

3.16 leakage Statement

Syntax: **leakage <wave>|<mode>|<load>|<test_ID>|<limit>|<units>**

Description: The **leakage** statement launches the "**HF Leakage**" menu of the vPad-RF app, passing to this menu the following information: the ESU output under test (cut, coag or bipolar); the mode by which the ESU is to be controlled (automatic footswitch, or manually-operated handswitch/footswitch); the resistance setting for the internal HF load bank (if used); the leakage test ID (1 through 7); and the maximum limit for the measured leakage (in mA or watts).

All arguments of the **leakage** statement must be specified. These arguments are:

wave Describes the waveform (i.e. surgical function) to which the ESU under test has been set. Typical examples would include descriptions such as "Monopolar Pure Cut"; "Monopolar Blend 2"; "Monopolar Spray Coag"; "Bipolar Precise" and so on. When the leakage test is completed, this description is then saved with the measurement results to provide a record of the ESU condition under which the test was performed.

mode Specifies which output of the ESU is being tested, and how the ESU is to be activated to perform the test. The settings defined for this argument are:

a-cut The monopolar CUT output of the ESU is activated automatically by vPad-RF, via a footswitch control cable.

a-coag The monopolar COAG output of the ESU is activated automatically by vPad-RF, via a footswitch control cable.

a-bipolar The BIPOLAR output of the ESU is activated automatically by vPad-RF, via a footswitch control cable.

m-cut The user will be prompted by vPad-RF to manually activate the monopolar CUT output of the ESU, via a footpedal control or a hand-operated control such as a "test pencil".

m-coag The user will be prompted by vPad-RF to manually activate the monopolar COAG output of the ESU, via a footpedal control or a hand-operated control such as a "test pencil".

m-bipolar The user will be prompted by vPad-RF to manually activate the BIPOLAR output of the ESU, via a footpedal control.

m-rf The user will be prompted by vPad-RF to manually activate the ESU. In this case, the particular output of the ESU that is under test is not explicitly specified in the **leakage** statement. The **m-rf** argument is for AutoSequence programs in which the necessary instructions for setup and testing of the ESU are provided by one or more **prompt** statements which precede the **leakage** statement. See the **ForceTriad PM Inspection** AutoSequence on the Android tablet for an example of how the **m-rf** argument may be used.

load The resistance setting of the internal load bank in the RF Analyzer unit, in ohms. This may be set to **none** if the HF load is not used in the test, or alternatively it may be an integer value which may range from 0 to 5115.

test_ID This is an integer ranging from 1 to 7 which specifies the type of leakage test to be performed. Available tests are as follows:

Test #1: for isolated monopolar output, measuring HF current from the active terminal of the generator to earth through a 200-ohm load. Note jumper P/N 7200-582 is used in this test.

Test #2: for isolated monopolar output, measuring HF current from the dispersive or neutral terminal of the generator to earth through a 200-ohm load (rated 16 watts).

Test #3: for earth-referenced monopolar output, measuring HF current from the dispersive terminal of the generator to the earth while the generator drives a specified load connected between active and dispersive terminals.

Test #4: for earth-referenced monopolar output, measuring HF current from the dispersive terminal of the generator to the earth while the generator drives a specified load connected between the active terminal and earth.

Test #5: for isolated bipolar output, measuring HF current from bipolar output terminal #1 to the earth through a 200-ohm test load. In this test, the monopolar dispersive terminal of the generator is also connected to the earth through a load.

Test #6: for isolated bipolar output, measuring HF current from bipolar output terminal #2 to the earth through a 200-ohm test load. In this test, the monopolar dispersive terminal of the generator is also connected to the earth through a load.

Test #7: cross-coupling test, measuring HF current from an unused output of the ESU while a different, independent output is activated to deliver power to a specified load resistance. Note this test does not appear in the IEC60601-2-2 standard, but is required by certain manufacturers for specific ESU models.

For more information on HF leakage testing, refer to Chapter 4 of **MN-110 6100-087** ***vPad-RF Operators Manual.***

`limit` A positive decimal number specifying the maximum limit for leakage.

`units` The units of measure of the leakage. This may be set to **`mA`** or **`watts`**.

Examples:

```
// Test pure cut, active lead to earth leakage; limit = 150 mA
// ESU CUT switched on/off automatically, by vPad-RF
leakage  "Monopolar PURE CUT, 300W" | a-cut | none | 1 | 150 | mA

// Test coag, dispersive lead to earth; 500 ohm load; limit = 150 mA
// ESU switched on/off manually by user, via footpedal control
leakage "Mono 1, SprayCoag, 120W" | m-coag | 500 | 2 | 150 | mA
```

Operation: When the **leakage** statement is executed, the HF Leakage menu of the vPad-RF app is launched and will appear similar to the example shown in ***Figure 23***.

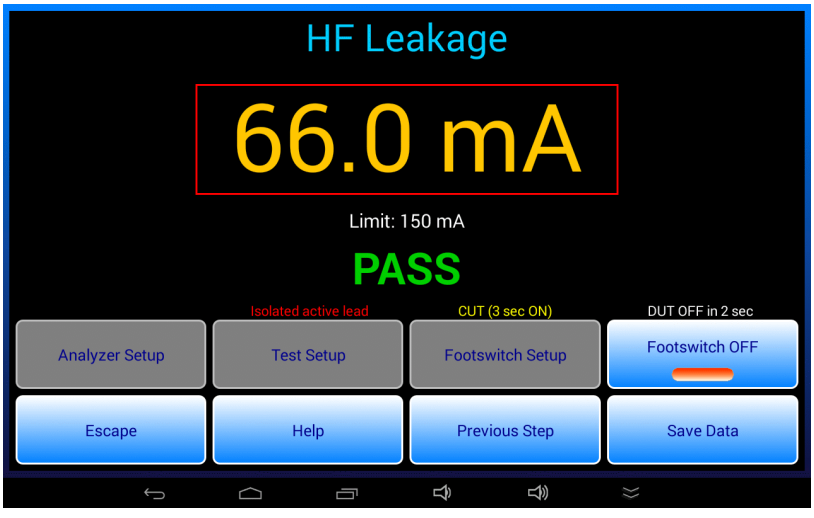

Figure 23

Operation of the HF Leakage menu in AutoSequence mode is very similar to operation of the HF Output menu described in Section 3.14. As set by the **mode** argument of the **leakage** statement, the cut, coag or bipolar receptacle of the ESU may be automatically activated by the footswitch output of vPad-RF, or alternatively the user may be prompted by a pop-up message to activate the ESU manually using a footpedal or hand-operated switch. If **autosave** is **off**, data shown on the "Save Leakage" menu are recorded and the sequence advances to the next statement when the menu's "Next Step" button is pressed. If **autosave** is **on**, and if the measured leakage is less than the limit, the measurement result is recorded automatically when the autosave timer counts down to zero. The recorded result includes the **wave** description which is copied from the **leakage** statement.

For further details on how execution of the **leakage** statement may be modified by preceding **autosave** and **timers** statements, refer to the operational description given for the **hftest** statement in Section 3.14.

3.17 remtest Statement

Syntax: **remtest <string>|<alarm>|<init_res>|<lim_type>|<limit_1>|<limit_2>**

Description: The **remtest** statement launches the "**REM (CQM) Test**" menu of the vPad-RF app, passing an initial resistance setting, pass/fail limit(s) and expected alarm response to the menu.

All arguments of the **remtest** statement must be specified, except for **limit_2** which is specified only when **lim_type** is set to **range**. The **remtest** arguments are:

string This is a text string intended to provide instructions to the user on how to adjust the value of the variable test resistor until an alarm indication is observed from the ESU under test.

alarm Specifies the expected alarm response of the ESU as either **on** or **off**.

init_res The initial setting of the variable test resistor when the statement is executed. This is an integer value ranging from 0 to 1023 ohms.

lim_type Determines how the setting of the variable test resistor is interpreted to derive the pass/fail result of the test.

- **match** The expected alarm response (**on** or **off**) must be observed when the test resistance is set equal to **limit_1** ohms
- **range** The expected alarm response (**on** or **off**) must be observed when the test resistance is set between **limit_1** and **limit_2** ohms
- **max** The expected alarm response (**on** or **off**) must be observed when the test resistance is set less than or equal to **limit_1** ohms
- **min** The expected alarm response (**on** or **off**) must be observed when the test resistance is set greater than or equal to **limit_1** ohms
- **info** The observed result is recorded as information only; no pass/fail result is to be assessed

limit_1 Pass/fail limit #1, according to the specified **lim_type** for the test. This is an integer value which may range from 0 to 1023 ohms.

limit_2 Pass/fail limit #2, according to the specified **lim_type** for the test. This is an integer value which may range from 0 to 1023 ohms.

Examples:

```
// Check ESU REM alarm is OFF when test resistance is set to 120 ohms
remtest  "Connect REM test cable to ESU now. Verify ESU alarm\n"\+
         "is OFF and REM indicator is GREEN."\+
         | off | 120 | match | 120

// Check ESU REM alarm goes ON if resistance increased to 130-140 ohm
remtest  "SLOWLY increase resistance until REM alarm sounds.\n"\+
         "Verify alarm resistance ranges from 130 to 140 ohms."\+
         | on | 120 | range | 130 | 140
```

Operation: When the **remtest** statement is executed, the REM (CQM) Test menu of the vPad-RF app is launched and will appear similar to the example shown in ***Figure 24***.

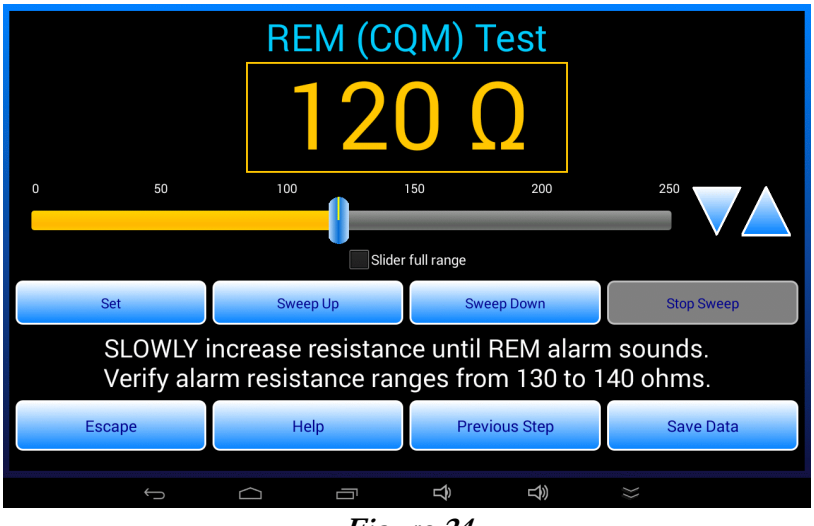

Figure 24

The **remtest** statement specifies the initial resistance setting (120 ohms in the example of ***Figure 24***), as well as the prompt which is displayed between the two button rows.

The user follows the displayed instruction and presses "Save Data" when the DUT alarms (or stops alarming, as the case may be). This causes the "Save REM Test Result" menu to be shown (***Figure 25***).

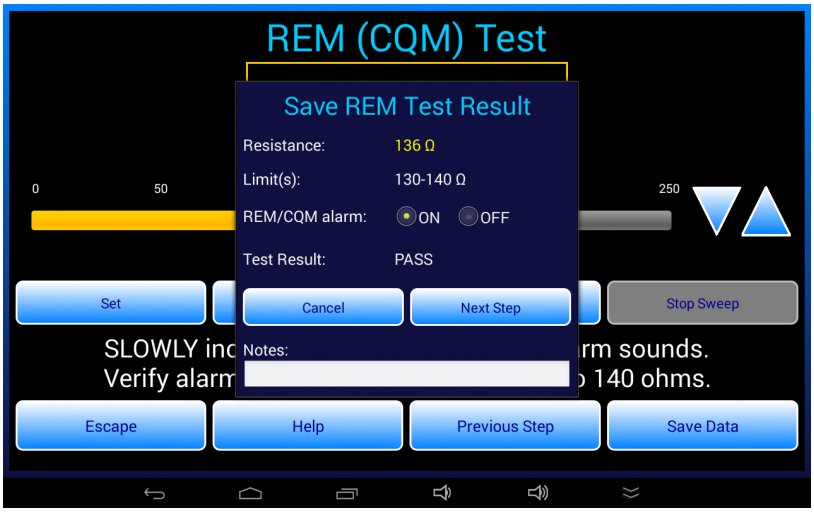

Figure 25

The user must select the alarm status (ON or OFF), which automatically sets the test result to "PASS" or "FAIL" and enables the "Next Step" button. When "Next Step" is pressed, the resistance, limit(s) and result are copied to the test record and the sequence proceeds to the next step. If this is the first REM test to be recorded, a data table is created in the Test Record. Subsequent **`remtest`** statements then append their results to the data table.

Typically, the REM function of a ESU will be verified through a sequence of **`remtest`** statements, each statement implementing one step of the manufacturer's PM procedure.

3.18 curve Statement

Syntax: **`curve <filename>`**

Description: The curve statement initiates a power curve test as configured according to the power curve file specified by **`<filename>`**.

Power curve files are stored in this folder of the Android tablet:

`<storage_media>/Datrend/vPad-RF/PowerCurves`

Power curve tests are configured with the vPad-RF app, using the Power Curve Editor menu. For more information on power curve programming, see Chapter 3 of **MN-110 6100-087** ***vPad-RF Operators Manual.***

Power curve files have a **`".pc"`** extension as part of the filename, which must be specified in the statement. However, the path to the file is implicit and is not to be included in the **`<filename>`**. Optionally, **`<filename>`** may be surrounded by quotes.

Example: **`curve "Cut 300W 50-200 ohm Auto.pc"`**

Operation: A power curve test launched by a **`curve`** statement executes in exactly the same way as if the test had been launched from the main menu of the vPad-RF app.

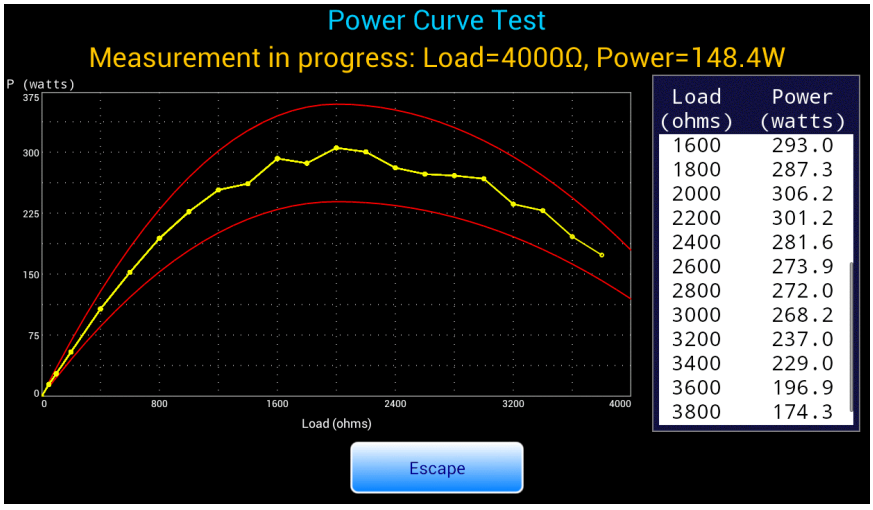

Figure 26

When the power curve graph is finished, buttons will appear at the bottom of the screen as shown in ***Figure 27***.

Figure 27

The only difference between the menu-driven version of the test an AutoSequence **`curve`** is that the latter will display a "Next Step" button when the test is complete. Typically, the user will need to manually choose a pass/fail test result as most power curve setups do not provide limit curves. After selecting the "PASS", "FAIL" or "Info" radiobutton, the "Next Step" button is pressed to advance the AutoSequence to the next step.

3.19 Statement Summary

Keyword	Argument 1	Argument 2	Argument 3	Argument 4	Argument 5	Argument 6
prompt	*message*	*style* (i.e. font)				
check	*message*					
show	*message*	*filename* (png *or* jpg) *(see NOTE 1)*				
hftest	*waveform description*	*DUT activation mode and output under test:* **a-cut**; **a-coag**; **a-bipolar**; **m-cut**; **m-coag**; **m-bipolar**; *or* **m-rf** *(see NOTE 2)*	*internal load resistance (ohms)*	*lower pass/fail limit*	*upper pass/fail limit*	*limit units* (**mA** *or* **watts**)
hftestx	*waveform description*	*DUT activation mode and output under test:* **a-cut**; **a-coag**; **a-bipolar**; **m-cut**; **m-coag**; **m-bipolar**; *or* **m-rf** *(see NOTE 2)*	*external load resistance*, *or intern : extern load resistances in series (ohms)*	*lower pass/fail limit*	*upper pass/fail limit*	*limit units* (**mA** *or* **watts**)
leakage	*waveform description*	*DUT activation mode and output under test:* **a-cut**; **a-coag**; **a-bipolar**; **m-cut**; **m-coag**; **m-bipolar**; *or* **m-rf** *(see NOTE 2)*	*internal load resistance (ohms)*	*leakage test ID* **(1 - 7)**	*pass/fail limit*	*limit units* (**mA** *or* **watts**)
remtest	*message*	*expected alarm response* (**on** *or* **off**)	*initial resistance setting (ohms)*	*limit type* (**match**; **range**; **max**; **min**; *or* **info**)	*first limit (ohms)*	*second limit (ohms)*
curve	*".pc" filename*					

Keyword	Argument 1	Argument 2	Argument 3	Argument 4	Argument 5	Argument 6
analyzer *(see NOTE 3)*	*range* **(1 - 5)** *or* **auto** *(default)*	*averaging* (**normal** *(default)*; **slow** *or* **mpulse**)	*trigger polarity and level* **(±1-99)** *%FS, default +5*			
autosave *(see NOTE 3)*	**off** *(default) or* **on**					
color *(see NOTE 3)*	*RGB colour ID (default white)*					
equip	*manufacturer*	*model*	*description*			
fans *(see NOTE 3)*	**off** *(default)* **low**, **medium** *or* **high**					
hfload *(see NOTE 3)*	*resistance (***0-5115** *ohms)*					
remres *(see NOTE 3)*	*resistance (***0-1023** *ohms)*					
timers *(see NOTE 3)*	*autosave time* (**2-10** *sec*)	*ESU on-time* (**1-20** *sec*)	*measurement delay (zero to ON-time minus 0.5 seconds)*			

NOTE 1: Argument 2 of the **show** statement can optionally specify a subfolder in the **AutoSequences/Show** folder which combines with the image filename to specify the path, for example: **ForceTriad/HF Output-ForceTriad Bipolar.png**

NOTE 2: **a-cut**, **a-coag**, **a-bipolar** specify ***a***utomatic control of the ESU CUT, COAG or BIPOLAR output respectively by means of the corresponding footswitch control relay of vPad-RF. **m-cut**, **m-coag**, **m-bipolar** specify ***m***anual test mode in which the "Activate CUT/COAG/BIPOLAR" pop-up message is displayed. **m-rf** is also a manual test mode except the pop-up message simply says "Activate RF now" rather than explicitly identifying a particular ESU output port (necessary for certain ESU PM procedures).

NOTE 3: This is a test sequence configuration command. If a change in configuration is needed in the middle of a script, two configuration statements may be required, one statement to effect the change moving forward through the script and a second statement to reverse the change when moving backward via the "Previous Step" button.

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